interposed therebetween;

wherein said semiconductor layer has at least one region including oxygen and overlapping both a portion of said channel region and a portion of said source and drain regions at a concentration of 1×10^{19} atoms/cm^3 or more.

REMARKS

Applicants wish to thank the Examiner for the very thorough consideration given the present application. The Examiner's Office Action of **January 18, 2001,** has been received and its contents carefully noted. Filed concurrently herewith is a *Request for a One (1) Month Extension of Time* that extends the statutory period for response to **May 18, 2001**. Accordingly, Applicants respectfully submit that this response is timely filed.

Claims 78-157 were pending in this application prior to the aforementioned amendment. Claims 78, 84, 89, 90, 96, 101, 102, 110, 118, 126, 134, 140, 146 and 152 have been amended to better encompass the full scope and breadth of the invention notwithstanding, Applicants believe that the claims would have been allowable as originally filed. Accordingly, Applicants assert that no new matter has been added and that the claims have not been narrowed within the meaning of *Festo*. Accordingly, claims 78-157 are still pending in this application and are believed to be in condition for allowance for the reasons stated below.

Initially, the Office Action objects to claims 78, 90 and 126 for containing an informality. In response thereto, the recitation "one ore more elements" has been amended to recite --one or more elements--, as suggested by the Examiner. Accordingly, reconsideration and withdrawal of the objection is respectfully requested.

Paragraphs 3-10 of the Office Action rejects claims 78, 80, 84, 86, and 89 under 35 U.S.C. 103(a) as being unpatentable over ***Wilson et al. '865***, claims 78-101, 110-115, 117-127, 129-138 and 146-157 under 35 U.S.C. 103(a) as being unpatentable over ***Wilson et al.***

'865 in view of ***Saito et al. '927*** and ***Shizukuishi et al. '348***, claim 116 under 35 U.S.C. 103(a) as being unpatentable over ***Wilson et al. '865*** in view of ***Saito et al. '927, Shizukuishi et al. '348*** and ***Solheim '784***, claims 128 and 139 under 35 U.S.C. 103(a) as being unpatentable over ***Wilson et al. '865*** in view of ***Saito et al. '927*** and ***Higashi '317***, claims 102-107, 109 and 140-144 under 35 U.S.C. 103(a) as being unpatentable over ***Wilson et al. '865*** in view of ***Saito et al. '927, Shizukuishi et al. '348*** and ***Ovshinsky et al.*** (U.S. Patent No. 4,766,471), claim 145 under 35 U.S.C. 103(a) as being unpatentable over ***Wilson et al. '865*** in view of ***Saito et al. '927, Shizukuishi et al. '348, Ovshinsky et al. '471*** and ***Higashi '317***, and claim 108 under 35 U.S.C. 103(a) as being unpatentable over ***Wilson et al. '865*** in view of ***Saito et al. '927, Shizukuishi et al. '348, Ovshinsky et al. '471*** and ***Solheim '784***. These grounds of rejection are respectfully traversed for the following reasons and favorable reconsideration is kindly requested in view thereof. Applicants incorporate by reference the remarks set forth in the *Amendment* filed November 28, 2000.

As the Examiner well knows, in formulating a rejection under 35 USC §103, the examiner must conduct the following four-level factual inquiry: determine the scope and content of the prior art; ascertain differences between the claimed invention and the prior art; resolve the level of ordinary skill in the pertinent art; and evaluate objective evidence of non-obviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966). In essence, to establish a *prima facie* case of obviousness, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 180 USPQ 580 (CCPA 1974).

Applicants respectfully submit that neither of the proposed modifications teach or suggest all the claim limitations of the amended claims. For instance, while the base reference ***Wilson et al. '865*** appears to disclose a region 42C in the semiconductor layer that contains nitrogen or oxygen, the nitrogen or oxygen region 42C is located only in source and drain regions (See Fig. 3). Even assuming, *arguendo*, that the nitrogen or oxygen regions

42C diffuses into the channel region 42B, the location of the boundary of the nitrogen or oxygen region 42C in the channel region is indeterminate. Accordingly, ***Wilson et al. '865*** fails to teach that one boundary of the nitrogen or oxygen region is formed in the channel region while the other boundary is formed in one of the source region and the drain region, as presently recited in amended claims 126 and 134.

Furthermore, it is inconclusive whether the channel region 42B of ***Wilson et al. '865*** includes nitrogen and oxygen at a concentration of 1×10^{19} atoms/cm^3 or more due to the diffusion from the source and drain regions since it is discloses doses of oxygen in a concentration of 10^{14}-10^{16}/cm^3 for source and drain regions (Col. 5, line 56). And it might have been obvious to provide the channel region of "10E15 to 5 x 10E17", this is not the legal standard for establishing a prima facie case of obviousness. There must be some teaching, suggestion, or motivation to combine or modify the teachings of the prior art to produce the claimed invention, found either in the references themselves or in the knowledge generally available to a skilled artisan. *In re Fine*, 837 F.2d 1071, 5 USPQ.2d 1596 (Fed. Cir. 1988). Accordingly, while it might have been obvious to use a dosage of "10E15 to 5 x 10E17", as disclosed in ***Wilson et al. '865***, it is Applicants' contention that it was not obvious to one of ordinary skill at the time of the invention to provide the claimed concentration of 1×10^{19}atoms/cm^3 or more.

Also, ***Saito et al. '927*** teaches that oxygen, nitrogen or carbon is introduced through the entire area of the channel region and the source and drain regions (See Fig. 1(a)). Thus, ***Saito et al. '927*** fails to disclose that the region containing oxygen, nitrogen or carbon overlaps both a portion of said channel region and a portion of said source and drain region, as presently recited in amended claims 102, 110, 118, 140, 146, 152. Nor does ***Saito et al. '927*** disclose that one boundary of the region containing oxygen, nitrogen or carbon is formed in the channel region while the other boundary is formed in one of the source region

and said drain region as presently recited in amended claims 126 and 134. Accordingly, even if the prior art references were combined as proposed in the Office Action, it would yield a device that fails to render obvious the claimed invention.

Furthermore, Applicants respectfully submit that a *prima facie* case of obviousness has not been set forth in the Office Action since the prior art references are non-analogous to the present invention. "In order to rely on a reference as a basis of rejection of an applicant's invention, the reference must either be in the applicant's field of endeavor or, if not, then be reasonably pertinent to the particular problem with which the inventor was concerned." *In re Oetiker*, 977 F.2d 1443, 1446 24 USPQ2d 1443, 1445 (Fed. Cir. 1992). In the instant case, the present invention is directed to a semiconductor device for use in an active-matrix display device. Since an advantageous result of the claimed invention is to reduce the current leakage, it is advantageous that the claimed invention be used in a pixel region of an active matrix type display device. A second advantageous result of the claimed invention is to increase the drain voltage resistance to thereby enhance the reliability of the display device. Moreover, since high operation speed is required for the peripheral circuit, it is advantageous that the claimed invention be used in a driver circuit of an active matrix type display device.

In contrast, while ***Wilson***, ***Saito*** and ***Solheim*** each appear to be directed to semiconductor devices, they are not employed for application in a active-matrix type display device. And while ***Higashi*** discloses a solid-state imaging device, it fails to teach an active matrix display device. None of the prior art references of record meet the second nexus as required to establish standard for hen since neither are reasonably pertinent to the particular problem with which Applicants were concerned. Consequently, one of ordinary skill in the art would not look to these references when faced with the aforementioned problems which are unique to active matrix type display devices. Accordingly, for the aforementioned

reasons, it is respectfully submitted that the amended claims are patentably distinct over the prior art.

For at least the above reasons, it is respectively asserted that claims 78-157 are now in proper condition for allowance and reconsideration of the pending rejections is respectively requested. If the Examiner believes that any further discussions would be beneficial in this case, he is invited to contact the undersigned.

Respectfully submitted,

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Marked-up copy of amended claims.

78. (Amended) A semiconductor device comprising:

a semiconductor layer including a channel region and source and drain regions in contact with said channel region [interposed therebetween] at a source-channel boundary and a drain-channel boundary, respectively;

a gate electrode adjacent to said channel region with a gate insulating film interposed therebetween; and

a region formed in said semiconductor layer, said region containing one [ore] or more elements selected from the group consisting of carbon, nitrogen, and oxygen at a concentration of 1×10^{19} atoms/cm^3 or more,

wherein said region is formed in the vicinity of [a boundary region between said channel region and one of said source region and said drain region] at least one of said source-channel boundary and said drain-channel boundary.

84. (Amended) A semiconductor device comprising:

a semiconductor layer including a channel region and source and drain regions in contact with said channel region [interposed therebetween] at a source-channel boundary and a drain-channel boundary, respectively;

a gate electrode adjacent to said channel region with a gate insulating film interposed therebetween; and

a region having a higher energy band gap than any of said source, drain, and channel regions,

wherein said region is formed in the vicinity of [a boundary region between said channel region and one of said source region and said drain region] at least one of said source-channel boundary and said drain-channel boundary.

89. (Amended) A device according to clam 84 wherein said region includes one [ore] or more elements selected from the group consisting of carbon, nitrogen, and oxygen at a concentration of 1×10^{19} atoms/cm^3 or more.

90. (Amended) A display device having a plurality of pixels and at least one driver circuit for driving said pixels, said driver circuit comprising:

a semiconductor layer including a channel region and source and drain regions in contact with said channel region [interposed therebetween] at a source-channel boundary and a drain-channel boundary, respectively;

a gate electrode adjacent to said channel region with a gate insulating film interposed therebetween; and

a region formed in said semiconductor layer, said region containing one [ore] or more elements selected from the group consisting of carbon, nitrogen, and oxygen at a concentration of 1×10^{19} atoms/cm^3 or more,

wherein said region is formed in the vicinity of [a boundary region between said channel region and one of said source region and said drain region] at least one of said source-channel boundary and said drain-channel boundary.

96. (Amended) A display device having a plurality of pixels and at least one driver circuit for driving said pixels, said driver circuit comprising:

a semiconductor layer including a channel region and source and drain regions with said channel region [interposed therebetween] at a source-channel boundary and a drain-channel boundary, respectively;

a gate electrode adjacent to said channel region with a gate insulating film interposed therebetween; and

a region having a higher energy band gap than any of said source, drain, and channel regions,

wherein said region is formed in the vicinity of [a boundary region between said channel region and one of said source region and said drain region] at least one of said source-channel boundary and said drain-channel boundary.

101. (Amended) A device according to clam 96 wherein said region containing one [ore] or more elements selected from the group consisting of carbon, nitrogen, and oxygen at a concentration of 1×10^{19} atoms/cm^3 or more.

102. (Amended) A display device having a plurality of pixels and at least one driver circuit for driving said pixels, said driver circuit comprising:

a semiconductor layer including a channel region and source and drain regions with said channel region interposed therebetween; and

a gate electrode adjacent to said channel region with a gate insulating film interposed therebetween;

wherein said semiconductor layer has at least one region including carbon [at least one boundary region in the vicinity of at least one of a source-channel boundary and a drain-channel boundary] and overlapping both a portion of said channel region and a portion of said source and drain regions at a concentration of 1×10^{19} atoms/cm^3 or more.

110. (Amended) A display device having a plurality of pixels and at least one driver circuit for driving said pixels, said driver circuit comprising:

a semiconductor layer including a channel region and source and drain regions with said channel region interposed therebetween; and

a gate electrode adjacent to said channel region with a gate insulating film interposed therebetween;

wherein said semiconductor layer has at least one region including nitrogen [at least one boundary region in the vicinity of at least one of a source-channel boundary and a drain-channel boundary] and overlapping both a portion of said channel region and a portion of said source and drain regions at a concentration of 1×10^{19} atoms/cm^3 or more.

118. (Amended) A display device having a plurality of pixels and at least one driver circuit for driving said pixels, said driver circuit comprising:

a semiconductor layer including a channel region and source and drain regions with said channel region interposed therebetween; and

a gate electrode adjacent to said channel region with a gate insulating film interposed therebetween;

wherein said semiconductor layer has at least one region including oxygen [at least one boundary region in the vicinity of at least one of a source-channel boundary and a drain-channel boundary] and overlapping both a portion of said channel region and a portion of said source and drain regions at a concentration of 1×10^{19} atoms/cm^3 or more.

126. (Amended) A display device having a plurality of pixels and at least one driver circuit for driving said pixels, each of said pixels comprising:

a semiconductor layer including a channel region and source and drain regions with said channel region interposed therebetween;

a gate electrode adjacent to said channel region with a gate insulating film interposed therebetween; and

a region formed in said semiconductor layer, said region containing one [ore] or

more elements selected from the group consisting of carbon, nitrogen, and oxygen at a concentration of 1×10^{19} atoms/cm^3 or more,

wherein one boundary of said region is formed in [the vicinity of a boundary region between] said channel region and the other boundary of said region is formed in one of said source region and said drain region.

134. (Amended) A display device having a plurality of pixels and at least one driver circuit for driving said pixels, each of said pixels comprising:

a semiconductor layer including a channel region and source and drain regions with said channel region interposed therebetween;

a gate electrode adjacent to said channel region with a gate insulating film interposed therebetween; and

a region having a higher energy band gap than any of said source, drain, and channel regions,

wherein one boundary of said region is formed [in the vicinity of a boundary region between] said channel region and the other boundary of said region is formed in one of said source region and said drain region.

140. (Amended) A display device having a plurality of pixels and at least one driver circuit for driving said pixels, each of said pixels comprising:

a semiconductor layer including a channel region and source and drain regions with said channel region interposed therebetween; and

a gate electrode adjacent to said channel region with a gate insulating film interposed therebetween;

wherein said semiconductor layer has at least one region including carbon [at least

one boundary region in the vicinity of at least one of a source-channel boundary and a drain-channel boundary] and overlapping both a portion of said channel region and a portion of said source and drain regions at a concentration of 1×10^{19} atoms/cm^3 or more.

146. (Amended) A display device having a plurality of pixels and at least one driver circuit for driving said pixels, each of said pixels comprising:

a semiconductor layer including a channel region and source and drain regions with said channel region interposed therebetween; and

a gate electrode adjacent to said channel region with a gate insulating film interposed therebetween;

wherein said semiconductor layer has at least one region including nitrogen [at least one boundary region in the vicinity of at least one of a source-channel boundary and a drain-channel boundary] and overlapping both a portion of said channel region and a portion of said source and drain regions at a concentration of 1×10^{19} atoms/cm^3 or more.

152. (Amended) A display device having a plurality of pixels and at least one driver circuit for driving said pixels, each of said pixels comprising:

a semiconductor layer including a channel region and source and drain regions with said channel region interposed therebetween; and

a gate electrode adjacent to said channel region with a gate insulating film interposed therebetween;

wherein said semiconductor layer has at least one region including oxygen [at least one boundary region in the vicinity of at least one of a source-channel boundary and a drain-channel boundary] and overlapping both a portion of said channel region and a portion of said source and drain regions at a concentration of 1×10^{19} atoms/cm^3 or more.